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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/788,105	02/16/2001	Jay E. Uglow	LAM1P106D	2844

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EXAMINER
PHAM, THANHHA S

ART UNIT	PAPER NUMBER
2813	10

DATE MAILED: 01/15/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	09/788,105	UGLOW ET AL.
	Examiner	Art Unit
	Thanhha Pham	2813

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *30 October 2002* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *21-24 and 26-41* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *21-24 and 26-41* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

This Office Action responses to Applicant's Response in Paper No. 9 dated 10/30/02.

Claim Rejections - 35 USC § 102

(e) the invention was described in-
(1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effect under this subsection of a national application published under section 122(b) only if the international application designating the United States was published under Article 21(2)(a) of such treaty in the English language; or
(2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that a patent shall not be deemed filed in the United States for the purposes of this subsection based on the filing of an international application filed under the treaty defined in section 351(a).

1. Claims 21-24, 26, and 36 rejected under 35 U.S.C. 102(e) as being anticipated by Liu et al [US 6,211,063].

Liu et al, fig 7 and col 1-6, discloses the claimed multi-layer dielectric layer/structure over a substrate for dual damascene applications comprising:

a barrier layer (35, a silicon nitride) disposed over the substrate (30) and a base dielectric (34);

an inorganic dielectric layer of a fluorined doped oxide (36, FSG, col 4 lines 13-19) disposed over the barrier layer; and

a low dielectric constant layer of a carbon-doped oxide layer (46, organic HSQ, fig 6, col 4 lines 48-57 and col 3 lines 24-26) disposed directly over the inorganic dielectric layer (36);

wherein the low dielectric constant layer is configured to receive metallization line trenches and the inorganic dielectric layer is configured to receive vias during a dual damascene process.

With respect to claim 26, the inorganic dielectric layer (36, FSG) has different material properties than the low dielectric constant layer (46, organic HSQ).

2. Claims 21-23 and 26-27 are rejected under 35 U.S.C. 102(e) as being anticipated by Wang et al [US 6,255,735]

Wang et al , fig 9 and cols 1-8, discloses the claimed multi-layer dielectric layer/structure over a substrate for dual damascene applications comprising:

a barrier layer (12, silicon nitride, col 5 lines 28-31) disposed over the substrate (10);

an inorganic dielectric layer of a fluorined doped oxide (14, SiOF, col 5 lines 40-41) disposed over the barrier layer; and

a low dielectric constant layer (18, col 5 lines 51-67 and col 6 lines 1-11) disposed directly over the inorganic dielectric layer (14);

wherein the low dielectric constant layer is configured to receive metallization line trenches and the inorganic dielectric layer is configured to receive vias during a dual damascene process.

With respect to claim 26, Wang et al (col 5 lines 51-67) discloses the inorganic dielectric layer (14) has different material properties than the low dielectric constant layer (18).

With respect to claim 27, Wang et al (col 5 lines 46-50) discloses the thickness of the inorganic dielectric layer (14) is about 4500 angstroms.

3. Claims 21-23, are rejected under 35 U.S.C. 102(e) as being anticipated by Smith [US 6,277,733].

Smith, fig 2c and col 1-5, discloses the claimed multi-layer dielectric layer over a substrate for dual damascene applications comprising:

a barrier layer (422, a silicon nitride, col 3 lines 26-27) disposed over the substrate;

an inorganic dielectric layer of un-doped TEOS oxide or fluorine-doped oxide (424, col 3 lines 25-27) disposed over the barrier layer;

a low dielectric constant layer (430, col 3 lines 56-62) disposed directly over the inorganic dielectric layer (424);

wherein the low dielectric constant layer is configured to receive metallization line trenches and the inorganic dielectric layer is configured to receive vias during a dual damascene process.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 23, 27-35, 37-41 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liu et al [US 6,211,063] in view Zhu et al [US 6,297,163].

⇨ With respect to claims 23 and 31, Liu et al, fig 7 and col 1-6, discloses a multi-layer dielectric layer/structure over a substrate for dual damascene applications comprising:

a barrier layer disposed over the substrate (30) and a base dielectric (34);

an inorganic dielectric layer (36, col 4 lines 13-19) disposed over the barrier layer; and

a low dielectric constant layer of a carbon-doped oxide layer (46, organic HSQ, fig 6, col 4 lines 48-57 and col 3 lines 24-26) disposed directly over the inorganic dielectric layer (36);

wherein the low dielectric constant layer is configured to receive metallization line trenches and the inorganic dielectric layer is configured to receive vias during a dual damascene process.

Lin et al does not expressly teach the inorganic dielectric layer (36) being of an un-doped TEOS oxide. Instead, Lin et al uses the inorganic dielectric layer (36) being of FSG.

However, Zhu et al shows un-doped TEOS oxide is a known material for forming an inorganic dielectric layer being configured to receive vias during dual damascene process (col 1 lines 10-20, col 2 lines 39-43, col 4 lines 11-67 and col 5 lines 1-15). Zhu et al also teaches un-doped TEOS oxide and FSG are equivalent material for the inorganic dielectric layer. Therefore, it would have been obvious for those skilled in the

art to use the un-doped TEOS oxide for the inorganic dielectric layer in the multi-layer dielectric layer/structure for dual damascene applications of Lin et al since Zhu et al teaches FSG and un-doped TEOS oxide can be used interchangeable. Moreover, selection of a known material based on its suitability for its intended use is prima facie obvious. *See Sinclair & Carroll Co., Inc. v. Interchemical Corp. , 325 U.S. 327, 65 USPQ 297 (1945).*

⇨ With respect to claims 27-30, 32-35, 37-41, the claimed ranged thickness of the inorganic dielectric layer and the low dielectric layer are considered to involve routine experimentation while has been held to be within the level of ordinary skill in the art. These claims are prima facie obvious without showing that the claimed ranges achieve unexpected results relative to the prior art range. In re Woodruff, 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See also In re Huang, 40 USPQ2d 1685, 1688(Fed. Cir. 1996)(claimed ranges of a result effective variable, which do not overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art). See also In re Boesch, 205 USPQ 215 (CCPA) (discovery of optimum value of result effective variable in known process is ordinarily within skill of art) and In re Aller, 105 USPQ 233 (CCPA 1955) (selection of optimum ranges within prior art general conditions is obvious).

5. Claims 27-30, and 41 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wang et al [US 6,255,735] in view of Usami [US 6,077,574] and Huang [US 2002/0054962].

⇨ With respect to claim 41, Wang et al, fig 9 and cols 1-8, discloses a multi-layer dielectric layer/structure over a substrate for dual damascene applications comprising:

a barrier layer (12, col 5 lines 28-31) disposed over the substrate (10);

an inorganic dielectric layer of a fluorine doped oxide (14, SiOF, col 5 lines 40-41) disposed over the barrier layer; and

a low dielectric constant layer (18, col 5 lines 51-67 and col 6 lines 1-11) disposed directly over the inorganic dielectric layer (14);

wherein a thickness of the inorganic dielectric layer of fluorine doped oxide is about 4500 angstroms and is configured to receive vias, and wherein the low dielectric constant layer is configured to receive metallization line trenches during a dual damascene process.

Wang et al does not expressly teaches: **(a)** the low dielectric constant layer (18) being of a carbon doped oxide; and **(b)** the thickness of the low dielectric constant layer being configured to receive metallization line trench is greater than the thickness of the inorganic dielectric layer of the fluorine doped oxide being configured to receive the vias.

Regard to **(a)**, Usami teaches using the carbon-doped oxide layer would provide a better low constant dielectric layer with good resistance to moisture and heat.

Regard to **(b),** the range thickness of the low dielectric layer to receive metallization line trench that is greater than the thickness of the inorganic dielectric layer of fluorine doped oxide to receive via in dual damascene process is considered to involve considered to involve routine experimentation while has been held to be within

the level of ordinary skill in the art. The claim is prima facie obvious without showing that the claimed ranges achieve unexpected results relative to the prior art range. In re Woodruff, 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). In addition, Huang (fig 3, paragraph [0044]) shows a thickness for the dielectric layer (70) to receive the metallization line trench can be larger than a thickness of the dielectric layer (66) to receive via in a dual damascene process.

Therefore, it would have been obvious for those skilled in the art to modify the multi-layer dielectric layer of Wang et al by **(a)** using the low constant dielectric layer of carbon doped oxide, as taught by Usami, to form the multi-layer dielectric layer with a good characteristics of low RC, good reistance to moisture and resistance to heat; and **(b)** having the thickness of the low dielectric constant of carbon doped oxide to receive the metallization line trench being greater than the thickness of the inorganic dielectric layer of fluorine doped oxide to receive the via in dual damascene process. According to **(a)**, Usami shows advantage of using the carbon doped oxide as the dielectric layer with high resistance to moisture & heat and low dielectric constant. According to **(b)**, those skilled in the art can select the thickness of the carbon doped oxide layer to receive the metallization line trench, in the multi-layered dielectric layer of Wang et al in view of Usami, being greater than the thickness of fluorine doped oxide layer to receive the via as a suitable thickness of the multi-layered dielectric layer for dual damascene application.

⇨ With respect to claims 27-30 and 41, the claimed ranged thickness of the inorganic dielectric layer and the low dielectric layer are considered to involve routine

experimentation while has been held to be within the level of ordinary skill in the art. These claims are prima facie obvious without showing that the claimed ranges achieve unexpected results relative to the prior art range. In re Woodruff, 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See also In re Huang, 40 USPQ2d 1685, 1688(Fed. Cir. 1996)(claimed ranges of a result effective variable, which do not overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art). See also In re Boesch, 205 USPQ 215 (CCPA) (discovery of optimum value of result effective variable in known process is ordinarily within skill of art) and In re Aller, 105 USPQ 233 (CCPA 1955) (selection of optimum ranges within prior art general conditions is obvious).

6. Claims 24-41 are rejected under 35 U.S.C. 103(a) as being unpatentable over Smith [US 6,277,733] in view of Usami [US 6,077,574].

With respect to claims 24, 31, 36 and 41, Smith, fig 2c and col 1-5, discloses the claimed multi-layer dielectric structrure for dual damascene applications comprising:

a barrier layer (422, col 3 lines 26-27) disposed over the substrate (402) and a base dielectric (416);

an inorganic dielectric layer of un-doped TEOS oxide or fluorine-doped oxide (424, col 3 lines 25-27) disposed over the barrier layer;

a low dielectric constant layer (430, col 3 lines 56-62) disposed directly over the inorganic dielectric layer (424);

wherein the low dielectric constant layer is configured to receive metallization line trenches and the inorganic dielectric layer is configured to receive vias during a dual damascene process.

Smith does not expressly teach using the low dielectric constant layer of carbon doped oxide.

However, Usami teaches using the carbon-doped oxide layer would provide a better low constant dielectric layer with a good resistance to moisture and heat.

Therefore, it would have been obvious for those skilled in the art to modify the multi-layer dielectric structure of Smith by using the low constant dielectric layer of carbon doped oxide, as taught by Usami, to provide a better multi-layered dielectric structure in dual damascene application for making a better device with low RC and good resistance to moisture & heat .

⇨ With respect to claim 26, those skilled in the art would recognize that the inorganic dielectric layer of fluorine doped oxide or un-doped TEOS oxide has different material properties than the low dielectric constant layer of carbon doped oxide in the combination multi-layered dielectric structure of Smith in view of Usami.

⇨ With respect to claims 27-30, 32-35, and 37-41, the claimed ranged thickness of the inorganic dielectric layer and the low dielectric layer are considered to involve routine experimentation while has been held to be within the level of ordinary skill in the art. These claims are prima facie obvious without showing that the claimed ranges achieve unexpected results relative to the prior art range. In re Woodruff, 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See also In re Huang, 40 USPQ2d 1685, 1688(Fed. Cir.

1996)(claimed ranges of a result effective variable, which do not overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art). See also In re Boesch, 205 USPQ 215 (CCPA) (discovery of optimum value of result effective variable in known process is ordinarily within skill of art) and In re Aller, 105 USPQ 233 (CCPA 1955) (selection of optimum ranges within prior art general conditions is obvious).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thanhha Pham whose telephone number is (703) 308-6172. The examiner can normally be reached on Monday-Thursday 8:00 AM - 7:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead Jr., can be reached on (703) 308-4940. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-3432 for regular communications and (703) 308-7725 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

Thanhha Pham
January 12, 2003

Carl Whitehead

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